**Claims.**

We claim:

1. A stopper rod system for use in a metallurgical vessel, comprising a stopper rod having a nose on one end thereof, and a nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the nozzle bore having a point of contact when the stopper rod system is in a closed position; wherein at least one of the stopper rod nose and the internal surface of the nozzle bore comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact.

2. A stopper rod system according to claim 1, wherein the size of the flow channel does not decrease downstream from the point of contact.

3. A stopper rod system according to claim 1, wherein the increase in size of the flow channel due to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact.

4. A stopper rod system according to claim 1, wherein the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact.

5. A stopper rod system according to claim 1, wherein the stopper rod nose comprises the plurality of ripples.

6. A stopper rod system according to claim 1, wherein the internal surface of the nozzle bore comprises the plurality of ripples.

7. A stopper rod system according to claim 1, wherein both of the stopper rod nose and the internal surface of the nozzle bore comprise a plurality of ripples.

8. A stopper rod for use in a stopper rod system, the stopper rod system comprising the stopper rod having a nose on one end thereof, and a nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the bore having a point of contact when the stopper rod system is in a closed position; wherein the stopper rod nose comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact.

9. A stopper rod according to claim 8, wherein the size of the flow channel does not decrease downstream from the point of contact.

10. A stopper rod according to claim 8, wherein the increase in size of the flow channel due

to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact.

11. A stopper rod according to claim 8, wherein the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact.

12. A nozzle for use in a stopper rod system, the stopper rod system comprising a stopper rod having a nose on one end thereof, and the nozzle having a bore therethrough, the bore having an internal surface, the stopper rod nose and the internal surface of the bore having a point of contact when the stopper rod system is in a closed position; wherein the internal surface of the nozzle bore comprises a plurality of ripples that are arranged such that the size of a flow channel when the stopper rod system is in an open position discontinuously increases in size as a function of the distance downstream from the point of contact.

13. A nozzle according to claim 8, wherein the size of the flow channel does not decrease downstream from the point of contact.

14. A nozzle according to claim 8, wherein the increase in size of the flow channel due to the ripple nearest the point of contact is greater than the increase in size of the flow channel due to the ripple immediately downstream of the ripple nearest the point of contact.

15. A nozzle according to claim 8, wherein the increase in size of the flow channel due to each successive ripple is alternately larger and smaller than the last with each successive ripple downstream from the point of contact.